

Claims.

1. Apparatus for introducing a liquid into a pharmaceutical container having a puncturable closure, comprising;
- 5 a hollow needle suitable for passing through the closure, the needle comprising a tubular conduit defined by a side wall and having an internal bore for the flow of a fluid along the bore in an flow direction, the conduit terminating externally at a pointed end, the bore terminating internally at a closed end, at least one orifice through the side wall for the exit of fluid flowing along the bore, the at
- 10 least one orifice being oriented to direct liquid flowing along the bore in a direction having a component parallel to the flow direction, the conduit having at least one vent groove in its outer surface;
- means to cause the needle to puncture the closure to the extent that the at least one orifice is within the container;
- 15 means to cause the liquid to flow along the bore;
- means to withdraw the needle from the container and closure.flow
2. Apparatus according to claim 1 comprising means to hold the needle and support the container, and to cause them to move relatively together along the
- 20 longitudinal axis of the needle.
3. Apparatus according to claim 3 wherein the container is a vial supported with its closure uppermost, and the needle is held above the container and moved downwardly toward the closure.
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4. Apparatus according to claim 2 or 3 wherein the container is supported on a conveyor below the needle holder.
5. Apparatus according to claim 2, 3 or 4 wherein the means to withdraw the
- 30 needle from the container and closure comprises the means to hold the needle and support the container, operating in a reverse reciprocal movement.

6. Apparatus according to claim 2, 3, 4 or 5 wherein the means to support the container incorporates means to restrain the container against the withdrawing force of the needle.
- 5 7. A hollow needle comprising a tubular conduit defined by a side wall and having an internal bore for the flow of a fluid along the bore in an flow direction, the conduit terminating externally at a pointed end, the bore terminating internally at a closed end, at least one orifice through the side wall for the exit of fluid flowing along the bore, the at least one orifice being oriented to direct liquid
10 flowing along the bore in a direction having a component parallel to the flow direction, the conduit having at least one vent groove in its outer surface and wherein the pointed end of the conduit is provided as a separate plug part which can be plugged into the downstream open end of the conduit.
- 15 8. A needle according to claim 3 which comprises:
a cylindrical tubular conduit defined by a side wall and having an internal bore for the flow of a fluid along the bore in an flow direction, the conduit terminating externally at a pointed end, the bore terminating internally at a closed end, at least one orifice through the side wall for the exit of fluid flowing along the
20 bore,
wherein at least one orifice has upstream and downstream perimeter surfaces through the side wall converging toward the upstream direction at an angle between 10-60° relative to the upstream direction,
the total cross sectional area of the one or more orifice is +/- 20% of the
25 cross sectional area of the bore of the conduit,
and the internal closed end of the bore comprises surfaces that converge toward the upstream direction.
9. A process for making a hollow needle according to claim 2 or 3 comprising
30 the steps of:

(1) providing a tubular conduit defined by a side wall and having an internal bore for the flow of a fluid along the bore in an flow direction, the bore having an open end;

5 (2) providing a plug part for the open end, the plug part having a longitudinal axis and being adapted to longitudinally mate with the open end of the bore and having an end surface and an opposite end,

(3) mating the plug part longitudinally with the bore,

(4) cutting at least one orifice through the side wall in a direction converging toward the upstream direction, and forming the end surface of the plug part into
10 side surfaces that converge toward the upstream direction,

(5) before or after any of steps (1) to (4) forming the opposite end of the plug part into a point.

10. A process according to claim 9 wherein prior to step (3) the end surface of
15 the plug part is formed into the shape of a valley with its bottom extending across the end surface perpendicular to the longitudinal direction.

11. A process according to claim 5 wherein in step (4) the orifice is cut by
20 drilling from a direction parallel to the line of the bottom of the valley.

12. A process for introducing a fluid into a puncturable container comprising the use of an apparatus according to any one of claims 1 to 6 to perform the steps of;

(1) inserting the point of the needle into the interior of the container by
25 puncturing the container,

(2) flowing a fluid along the bore of the needle in the flow direction,
(3) causing the fluid to exit the needle through the one or more orifice and
thereby enter the container, then

(4) withdrawing the needle from the container.

30 13. A process for introducing a fluid into a puncturable container comprising the steps of;

- (1) inserting the point of a needle as claimed in claim 7 or 8 into the interior of the container by puncturing the container,
- (2) flowing a fluid along the bore of the needle in the flow direction,
- (3) causing the fluid to exit the needle through the one or more orifice and
- 5 thereby enter the container, then
- (4) withdrawing the needle from the container.

14. A process according to claim 13 wherein the container is a pharmaceutical vial having a puncturable closure.